

Appl. No. 10/811,442
Amdt. Dated Feb. 28, 2006
Reply to Office Action of Nov. 28, 2005

REMARKS

Applicant has amended claims 1, 7-9, and 18, has canceled claims 2 and 10, and has added new claim 20. No new matter has been entered. Claims 1, 3-10, and 11-20 are now pending in the application.

Claim Objections

Claims 1, 7-9, and 18 are objected to, based upon various informalities. Such claims have been amended, keeping in mind the comments offered by the Examiner. Applicant further respectfully submits that it has been held that broad claim terminology is not inherently indefinite. Accordingly, Applicant hereby respectfully requests the withdrawal of such objections and submits that such claims are now in allowable form.

Claim Rejections Under 35 U.S.C. 102(e)

Claims 1, 4, 7-9, 11, 14 and 15 are rejected under 35 U.S.C. 102(e), as being anticipated by Han et al. (US 6515415B1).

Responsive thereto, Applicant has amended claims 1 and 7-9 and hereby otherwise traverses the rejection of claims 1, 4, 7-9, 11, 14 and 15 under 35 U.S.C. 102(e), based upon Han et al. '415.

Amended claim 1 recites in part:

A carbon nanotube-based field emission device comprising: ...

wherein the root end defines a planar surface which is

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exposed outwardly and acts as an emitter, a flatness of the planar surface of the root end of the carbon nanotube array is less than 1 micron, and the growth end is embedded into the cathode electrode.

The Examiner contends that Han et al. '415 discloses a "carbon nanotube-based field emission device" including "a carbon nanotube array... having a growth end... and an opposite root end..." The Examiner interprets "the end of the carbon nanotube that is not attached to the cathode as [being] the root end..." The Examiner further relies on Fig. 3 for support of the root end defining "a substantially planar surface". However, Applicant submits that it has been held that the drawings cannot be relied upon for dimensional detail unless particularly stated to have been drawn to scale. As such, Fig. 3 cannot be relied upon as a teaching of a particular planarity, especially the flatness as set forth in amended claim 1. In Sections 23-24 of the Office Action, the Examiner essentially admits this point. Accordingly, Applicant submits that Han et al. '415 fails to teach or suggest claim 1, as amended.

With further respect to Sections 23-24 of the Office Action, the Examiner introduces Dai et al. (U.S. 6,232,706) as a teaching of bundles of nanotubes with a "flat" surface in attempt to overcome a stated shortcoming in Han et al. However, Dai et al. '706 is silent to the degree of flatness of such nanotube bundles. In fact, in describing the method of manufacture used thereby, Dai et al. '706 states that the "above method for making nanotube bundles produces mainly flat-top bundles..." (Col. 4, lines 11-13). Thus, upon closer examination of the reference, Dai et al. '706 is not at all specific about the degree of flatness and, if anything, would seem to suggest

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that a rather sizable level of variability is to be expected (i.e., "mainly" is typically open to a broad interpretation). Particularly, for a flatness of less than one micron to be possible over the array, the nanotubes must extend to an essentially equal lateral position (i.e., a given height) and be of an appropriate individual flatness. Simply put, Dai et al. '706, when considered as a whole, does not teach or suggest, with sufficient specificity, enough detail to meet the flatness limitation of claim 1, as amended, instead requiring an impermissible "obvious to try" (MPEP §2145.X.B.) standard to be implemented. Accordingly, the combination of Han et al. '415 in view of Dai et al. '706 fails to render obvious claim 1, as amended.

Accordingly, amended claim 1 is submitted to be novel, unobvious and patentable over Han et al. under 35 U. S. C. 102(e) and even over Han et al. in view of Dai et al. under 35 U.S.C. 103(a). Reconsideration and withdrawal of the rejection and allowance of amended claim 1 are respectfully requested.

Amended claim 9 recites in part:

A carbon nanotube-based field emission device
comprising: . . .

wherein the root end defines a planar surface which is exposed outwardly and acts as an emitter, a flatness of the planar surface of the root end of the carbon nanotube array is less than 1 micron, and the growth end is embedded into the cathode electrode.

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As amended claim 9 recites similar subject matter as set forth above with respect to amended claim 1, Applicants submit that amended claim 9 is also novel, unobvious, and patentable over Han et al. under 35 U. S. C. 102(e) and even over Han et al. in view of Dai et al. under 35 U.S.C. 103(a). Reconsideration and withdrawal of the rejection and allowance of amended claim 9 are respectfully requested.

Claims 4, 7, and 8 and claims 11, 14, and 15 depend directly from the amended claims 1 and 9, respectively, which are in condition for allowance for the reasons set forth above. Accordingly, Applicant submits claims 4, 7, and 8 and claims 11, 14, and 15 are now in condition for allowance, the allowance of which is hereby respectfully requested.

Claims 16-19 are rejected under 35 U.S.C. 102(e) as being anticipated by Chang et al. (US 2003/0044537A1).

Responsive thereto, Applicant has amended claim 18 and otherwise respectfully traverses this rejection based upon Chang et al. '537.

Claim 16 recites in part:

A method of making a carbon nanotube-based field emission device, comprising steps of: ...

growing a carbon nanotube array on said catalyst layer wherein carbon nanotubes in said array extend from said catalyst layer with roots and define different heights with tips;

applying a cathode electrode to said tips of said carbon

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nanotubes...

The Examiner contends in the Office Action that Chang et al. discloses: “forming a carbon nanotube layer on the first conducting layer and a protection layer on the carbon nanotube layer (paragraph 0014)”, relying on an interpretation that the protection layer 27 is the catalyst layer. However, Chang et al. discloses, in Paragraph [0029], as “shown in FIG. 3C, carbon nanotube layer 26 are formed on the conducting layer 22 for electron emission. A protection layer 27 is also formed on the carbon nanotube layer 26. The carbon nanotube layer 26 and protection layer 27 are then sintered. The protection layer 27 protects the carbon nanotube layer 26 from damages during sintering and sandblasting.” Accordingly, Chang et al. clearly does not disclose or suggest depositing the carbon nanotube layer 26 on the protection layer 27, the opposite instead being disclosed. Furthermore, Chang et al. does not disclose or suggest that protection layer 27 is configured for and/or even capable of functioning as a catalyst material (i.e., able to promote a chemical reaction/process). As such, Chang et al. fails to teach or suggest “growing a carbon nanotube array on said catalyst layer”, as required by claim 16.

Secondly, Chang et al. does not clearly disclose or suggest the step of “applying a cathode electrode to said tips of said carbon nanotubes”, as provided in claim 16. Particularly, in Chang et al., the carbon nanotube layer 26 is initially formed on the conducting layer 22, and it is that layer 22 which acts as the cathode in Chang et al. As such, the cathode layer of Chang et al. is not applied to “tips of said carbon nanotubes” as per claim 16. Thus, Chang et al. fails to teach or suggest the subject matter of claim 16.

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Accordingly, claim 16 is submitted to be novel, unobvious, and patentable over Chang et al. or any of the other cited references, taken alone or in combination. Reconsideration and withdrawal of the rejection and allowance of claim 16 are respectfully requested.

Claims 17-19 depend directly or indirectly from the claim 16, which is in condition for allowance for the reasons set forth above. Accordingly, Applicant submits claims 17-19 are now in condition for allowance, the allowance of which is hereby respectfully requested.

Claims 3, 5, 6, 12 and 13 are rejected under 35 U.S.C. 103(a) as being anticipated over Han et al. (U.S. 6,515,415B1) in view of Nakamoto (U.S. 6,097,138B1).

Claims 3, 5, and 6, and claims 12 and 13 depend directly from claims 1 and 9, respectively, which are in condition for allowance for the reasons set forth above. Accordingly, Applicant submits claims 3, 5, 6, 12 and 13 are now in condition for allowance, the allowance of which is hereby respectfully requested.

Claims 2 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Han et al. (U.S. 6,515,415B1) in view of Dai et al. (U.S. 6,232,706B1).

Claims 2 and 10 have been canceled, the subject matter of which has been incorporated into claims 1 and 9, respectively. As set forth with respect to claims 1 and 9 above, Applicant submits that the subject matter of now-canceled claims 2 and 10 is neither taught, disclosed, nor suggested by

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Han et al., Dai et al., or any of the other cited references, taken alone or in combination.

Applicant has added new claim 20. Support for this claim can be found at, e.g., Paragraphs [0020]-[0023]. Furthermore, Applicant submits that none of the cited references, taken alone or in combination, discloses or suggests the use of the claimed working plate. As such, Applicant submits that new claim 20 sets forth allowable subject matter. Accordingly, the allowance of claim 20 is hereby respectfully requested.

In view of the foregoing, the present application as claimed in the pending claims is considered to be in a condition for allowance, and an action to such effect is earnestly solicited.

Respectfully submitted,
Liang Liu

By 
Jeffrey T. Knapp

Registration No.: 45,384

Foxconn International, Inc.

1650 Memorex Drive

Santa Clara, CA 95050

Tel. No.: 714/626-1229